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**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE**

**IN ACTUARIAL SCIENCE**

**4TH YEAR 1ST SEMESTER 2016/2017 ACADEMIC YEAR**

**MAIN CAMPUS**

**COURSE CODE: SAS 405**

**COURSE TITLE: ANALYSIS OF EXPERIMENTAL DESIGN II**

**EXAM VENUE: STREAM: Bsc. ACTUARIAL SCIENCE**

DATE: EXAM SESSION:

TIME: 2.00 HOURS

**Instructions:**

1. **Answer ANY 3 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

**QUESTION ONE (30 MARKS)**

1. Define following terms as used in block design. (8 Marks)
2. Balanced design.
3. Proper design.
4. Symmetric balanced incomplete block design.
5. Resolvable design.
6. Distinguish between complete and incomplete block designs (2 Marks)
7. Explain the three principles of experimentation. . (6 Marks)
8. Test whether the following types of wheat have significance difference at 0.05 level. (14 Marks)

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | D |
| 25 | 19 | 22 | 23 |
| 24 | 21 | 23 | 24 |
| 28 | 25 | 26 | 26 |

**QUESTION TWO (20 MARKS)**

The table below is yields of 6 varieties in 4 replicate experiments for which 1 value is missing. Estimate the missing value and analyze the data for homogeneity of the treatments and blocks at 0.05 level of significance. (20 Marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 |
| 1 | 18.5 | 17.7 | 15.4 | 16.5 |
| 2 | 15.7 | \_\_\_ | 16.6 | 18.6 |
| 3 | 16.2 | 12.9 | 15.5 | 12.7 |
| 4 | 14.1 | 14.4 | 20.3 | 15.7 |
| 5 | 13.0 | 16.9 | 18.4 | 16.5 |
| 6 | 13.6 | 12.5 | 21.5 | 18.0 |

**QUESTION THREE (20 MARKS)**

Does the season of the year make any difference in the mileage of a car that it is capable of getting?

Consumer organization undertook to answer this question. During winter, spring, summer and autumn fall, 6 cars of a particular model were selected, 3 of the 6 cars were manual and 3 automatic transmissions. In each case the car was driven over an identical course and mileage recorded. The following results were obtained.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Winter | Spring | Summer | Fall |
| Manual | 20.9  21.3  21.7 | 22.4  22.9  22.2 | 22.0  22.3  21.7 | 23.6  23.0  23.0 |
| Automatic | 19.5  20.3  20.8 | 22.0  21.5  21.3 | 21.4  20.7  20.9 | 21.9  22.6  21.5 |

Test at 0.01 level of significance

1. Significance between difference seasons
2. Significance difference between types of transmissions
3. Interactions

**QUESTION FOUR (20 MARKS)**

1. An experiment was conducted to compare the effect of v=7 chemical substances on the male rats. The area of the experimentation on an animal skin was confined to a region which was known to be homogeneous but this restricted the experiment to 3 exponential units (Porches of skin) per animal. Hence to eliminate the rat to rat variability the comparison of treatments, the experiment was blocked by the rats using
2. Balanced Incomplete Block Design shown below.

|  |
| --- |
| 1 |
| 10.2 |
| 6.9 |
| 14.2 |

|  |
| --- |
| 2 |
| 12.9 |
| 14.1 |
| 9.9 |

|  |
| --- |
| 3 |
| 11.7 |
| 12.1 |
| 8.6 |

|  |
| --- |
| 4 |
| 9.1 |
| 7.7 |
| 14.3 |

|  |
| --- |
| 5 |
| 8.8 |
| 8.6 |
| 16.3 |

|  |
| --- |
| 6 |
| 9.2 |
| 15.2 |
| 13.1 |

|  |
| --- |
| 7 |
| 11.3 |
| 9.7 |
| 6.2 |

k=3

r=3

b=v=7



The 7 blocks corresponding to 7 rats . Find out whether the data present evidence to indicate a real difference in the effect of chemical substance on the skin at 5% level of significance. (14 Marks)

1. Explain three principles of fractional designs. (6 Marks)

**QUESTION FIVE (20 MARKS)**

The following table gives the layout and results of a factorial design laid out in 4 replicates. The purpose of the experiment is to determine the effects of different kind of fertilizers nitrogen (n), potash (k) and phosphate (p) in potato crops. Find at 0.05 level of significance whether the treatments are homogeneous. (20 Marks)

|  |  |  |  |
| --- | --- | --- | --- |
| Block 1 | | | |
| nk  291 | Kp  391 | p  312 | np  373 |
| I  101 | K  265 | n  106 | npk  450 |

|  |  |  |  |
| --- | --- | --- | --- |
| Block 2 | | | |
| kp  407 | p  324 | k  272 | nk  306 |
| n  89 | nkp  449 | np  338 | I  106 |

|  |  |  |  |
| --- | --- | --- | --- |
| Block 3 | | | |
| p  323 | I  87 | np  324 | kp  423 |
| nk  334 | K  279 | n  128 | npk  471 |

|  |  |  |  |
| --- | --- | --- | --- |
| Block 4 | | | |
| np  361 | nk  272 | n  103 | p  324 |
| k  302 | I  131 | nkp  437 | kp  435 |